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IS 9002-1 (1977): Equipment for Environmental Tests for Electronic and Electrical Items, Part I: Chamber for Cold Test [LITD 1: Environmental Testing Procedure]

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IS : 9002 (Part I) - 1977

Indian Standard
SPECIFICATION FOR
EQUIPMENT FOR ENVIRONMENTAL TESTS
FOR ELECTRONIC AND ELECTRICAL ITEMS

PART I CHAMBER FOR COLD TEST

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SPECIFICATION FOR EQUIPMENT FOR ENVIRONMENTAL TESTS FOR ELECTRONIC AND ELECTRICAL ITEMS

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Indian Standard

SPECIFICATION FOR
EQUIPMENT FOR ENVIRONMENTAL TESTS
FOR ELECTRONIC AND ELECTRICAL ITEMS

PART I CHAMBER FOR COLD TEST

0. FOREWORD

0.1 This Indian Standard (Part I) was adopted by the Indian Standards Institution on 30 May 1977, after the draft finalized by the Environmental Testing Procedures Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 The object of this standard (Part I) is primarily to guide the environmental equipment manufacturers with respect to broad specifications for their equipment and to assist the users of such equipment to properly define the requirements in the indent for the equipment. The requirements of the equipment largely depend on the conditions of environmental tests to be simulated or created. It is expected that this standard will harmonise the various requirements of the equipment.

0.3 Certain requirements have been specified in a general form in view of practical difficulties in defining such requirements quantitatively. It is presumed that with the experience gained, more precise requirements will be laid down for such equipment.

0.4 An overall performance assessment of the complete equipment for a short duration has been included although it may be realised that it may not be entirely sufficient. This will at least ensure the functional performance and operability of the equipment. Many of the constructional requirements specified can be checked through visual examination.

0.5 In view of the subjective nature of some of the requirements, sufficient care shall be taken in using the standard.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Rules for rounding off numerical values (revised).

1. SCOPE

1.1 This standard (Part I) lays down guiding requirements for the design of cold chamber required for carrying out cold tests in accordance with IS : 9000 (Part II)-1977*.

2. TERMINOLOGY

2.1 For the purpose of this standard, the definitions and explanation of terms given in IS : 9000 (Part I)-1977† shall apply.

3. TEMPERATURE

3.1 The chamber shall be capable of maintaining the specified temperature in the working space, within the tolerance required, at any point in the working space of the chamber, for the specified duration.

NOTE — The refrigeration system employed to maintain the low temperature shall be such as to ensure close temperature accuracy over the operating temperature range of the chamber.

3.1.1 The preferred temperature range shall be chosen from the following unless otherwise specified:

- a) From ambient up to -25°C ,
- b) From ambient up to -40°C , and
- c) From ambient up to -65°C .

NOTE — The temperature range of the chamber required and the ambient temperature shall be indicated by the purchaser.

3.1.2 The chamber shall be capable of maintaining the following temperatures in so far as they fall within the temperature range of the chamber:

- $-65 \pm 3^{\circ}\text{C}$
- $-55 \pm 3^{\circ}\text{C}$
- $-40 \pm 3^{\circ}\text{C}$
- $-25 \pm 3^{\circ}\text{C}$
- $-10 \pm 3^{\circ}\text{C}$
- $+ 5 \pm 3^{\circ}\text{C}$

NOTE — The tolerance may be modified depending on the size of the chamber.

3.1.3 The chamber shall be capable of maintaining the temperature specified in **3.1.1** at least for 96 hours continuously in any single run.

*Basic environmental testing procedures for electronic and electrical items: Part II Cold test.

†Basic environmental testing procedures for electronic and electrical items: Part I General.

3.1.4 Unless otherwise specified, the temperature at any point inside the chamber shall be within $\pm 3^{\circ}\text{C}$ of the test temperature.

3.1.5 It shall be possible to control the rate of change of temperature not to exceed 1°C per minute averaged over a period not exceeding 5 minutes.

3.1.6 In order to limit radiation problems the temperature of the walls of the chamber, after temperature stability has been reached, where relevant, shall not differ by more than 8 percent of specified temperature of the test chamber in $^{\circ}\text{K}$. This requirement applies to all parts of the chamber walls and the items shall be unable to 'see' any heating or cooling elements which do not comply with this requirement.

3.2 Provision may be made for forced air circulation to maintain homogeneous conditions within the chamber. The velocity of air in such a case should be as low as possible. The means for circulation of the air shall not protrude into the working space.

3.2.1 In the case of chamber for testing heat dissipating items with no forced air circulation the chamber shall be large enough compared with the size and amount of heat dissipation of the test item to allow a simulation of the effects of free air conditions.

NOTE — This requirement may be met by designing and choosing the size of the chambers such that the minimum distance between any surface of the test item and the corresponding wall of the chamber is not less than 15 cm and the ratio between the volume of the chamber and the volume of the item is not less than 5 : 1. The chambers shall be such that the item should as far as practical be placed closed to the centre of the test chamber so as to have as much space as possible between any part of the test item and the chamber wall.

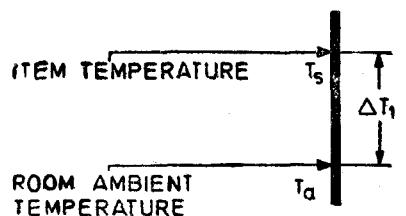
3.3 The temperature in the chamber shall be checked by temperature sensing devices located so as to comply with the conditions specified in **3.1.2** of IS:9000 (Part I)-1977*.

3.4 Where required, the chamber shall be capable of maintaining the temperature in accordance with the specified duty cycle. Due provision shall be available in such a case to maintain the test temperature at a steady figure, if required.

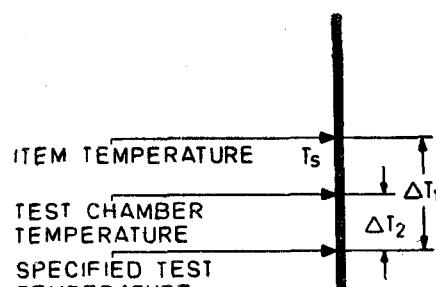
NOTE 1 — In the case of components, a staggering of the on-periods will usually suffice, provided that any time the distribution of components on-load reasonably uniform throughout the test chamber.

NOTE 2 — Where a duty cycle is specified, the design of the chamber shall be such that during the off load periods the temperature of the chamber shall not fall below the specified test temperature (see Fig. 1).

*Basic environmental testing procedures for electronic and electrical items: Part I General.



Stage 1 — Item loaded. Test in laboratory conditions with no forced air circulation. Measurement of item temperature.



Stage 2 — Item loaded. Test in chamber with forced air circulation. Monitoring on item temperature. [ΔT_2 should be small. Measuring of test chamber temperature is carried out in accordance with 2.1 of IS : 9000 (Part I)-1977].*

FIG. 1 DIAGRAMMATIC REPRESENTATION OF TEST WITH FORCED AIR CIRCULATION

4. CONSTRUCTION, WORKMANSHIP AND FINISH

4.1 General

4.1.1 The chamber is to be fabricated preferably with welded steel of sufficient thickness to provide necessary mechanical strength. Corners and seams of the interior liners are to be so welded to allow for expansion and contraction under all temperature changes to prevent distortion and damage.

4.1.2 The materials used for the construction of interior walls of the chamber shall be of stainless steel of the non-corrosive type preferably.

4.1.3 The chamber shall be so constructed as to have the following provisions:

- a) For draining condensed water off the chamber;
- b) For air pressure equalization, when required; and
- c) To dry the air passing through the chamber preferably through a dehumidifier.

*Basic environmental testing procedures for electronic and electrical items: Part I General.

4.2 Working Volume — The working volume of the chamber should be chosen from the following preferred values unless otherwise specified:

0·25, 0·5, 1, 2·5 m³

4.3 Insulation — The chamber shall be suitably and sufficiently insulated for the temperature range involved. Insulation and insulated space shall be properly sealed so as to prevent deterioration and loss of cooling effect.

NOTE — The minimum permissible external surface temperature has to be specified by the purchaser.

4.4 Doors — A suitable front door shall be provided which shall be capable of full opening to ensure full access to the working space. The door shall be fitted with suitable gaskets to prevent infiltration of external air and moisture. The door and gasket shall withstand pressure and temperature range involved without undue distortion or deterioration. The perimeter of opening may be provided with thermostatically controlled heating elements of low density to prevent freezing.

4.5 Shelves — Removable, perforated shelves capable of supporting without distortion the items of specified mass shall be provided. The number of shelves and adjustable heights are to be as specified.

4.6 Viewing Window with Wiper — A viewing window of the required dimension with wiper shall be provided on the door preferably of the multipanel type, hermetically sealed.

4.7 Terminal Panel — As an optional facility, a suitable terminal panel for making external connections with the test items inside the chamber shall be provided and so designed as to prevent condensation on exterior of terminals. The relevant details and requirements, for example, voltage and current levels are to be as specified.

4.8 Porthole — One or more porthole of specified dimensions may be provided as an optional item at the specified point of the chamber for accommodating wires, hoses, etc. Means shall be provided for sealing of the porthole when not in use to ensure thermal integrity.

4.8.1 In case of large chambers, an additional porthole may be provided to operate the equipment under test without opening the chamber door. In this case suitable bellows or gloves may be specified to cover the porthole as well as to operate the item under test.

4.9 Interior Light — Provision shall be made for illuminating the working space by incandescent lamps with watertight fittings. The lamps shall be so positioned as not to project into the working space.

4.10 Workmanship — The workmanship shall be of good current engineering practice.

4.11 Finish — The external and internal finish of the chamber shall be as specified for parts and not otherwise covered so as to ensure protection against corrosion and other similar effects.

4.12 Miscellaneous

4.12.1 The chamber shall be designed for optimum performance and economic continuous operation with minimum maintenance requirement. It shall occupy minimum floor area.

4.12.2 The electrical and electronic components and cables shall conform to relevant Indian Standards, wherever available.

4.12.3 Provision of castor wheels shall be made for easy movability of the equipment, if required.

4.12.4 The chamber may be provided with a hot gas defrost arrangement to fully defrost the refrigeration system.

5. INSTRUMENT CONSOLE

5.1 An instrument console consisting of required instruments should preferably be fitted to the chamber for ease of operation. This instrument console should include, inter-alia, the following:

- a) Indicating panel consisting of mains on-off switch, mains-on indicator lamp, on-off switch for refrigeration system and for air circulation.
- b) Necessary instruments for controlling and recording of the temperature and relative humidity. The temperature control stability shall be within $\pm 0.5^{\circ}\text{C}$.

5.1.1 Provision for automatic test programming be made as an optional facility, if required.

6. POWER SUPPLY REQUIREMENTS

6.1 The test equipment shall be capable of operating from an ac supply of 50 Hz either from single phase 240 V or three phase 415 V. Total power supply input shall be declared by the manufacturer as required by the purchaser.

7. SAFETY

7.1 Adequate electrical safety arrangement shall be incorporated in the chamber design to avoid electric shock and damage to the chamber.

7.2 The safety protections should be as follows:

- a) Protection against supply voltage variation,
- b) Safety cut-outs for low temperature/low pressure and on all compressor units,
- c) Adequate heat/electrical insulation at control panel,
- d) Door lock safety, and
- e) Safety alarm (visual and audio) in case of chamber malfunctioning where required.

8. MARKING

8.1 The equipment shall be marked with the following information:

- a) Manufacturer's name or trade-mark,
- b) Type designation,
- c) Working volume and range of operating conditions,
- d) Power supply requirements, and
- e) Any other additional marking as required.

9. TESTS

9.1 Each chamber shall be subjected to the following tests:

- a) Visual examination and inspection, and
- b) Performance.

9.2 Visual Examination— Each chamber shall be visually examined and inspected for compliance with the relevant requirements of the standard.

9.3 Performance— Each chamber shall be subjected to performance run at specified temperature (*see 3*) for a minimum period of 96 hours continuously. Temperatures shall be recorded throughout the test and the observed performance should meet the specified requirements.

10. INSTRUCTION MANUAL

10.1 Each chamber shall be provided with instruction manual which shall contain the following:

- a) Operating instruction,
- b) Maintenance and service instruction,
- c) Schematic diagrams and design of layout,
- d) List of component parts with performance data, and
- e) List of spare parts.

11. INFORMATION TO BE FURNISHED BY THE INDENTOR

11.1 The following information shall be furnished by the indentor:

- a) Temperature range of the chamber (*see 3.1.1*);
- b) Ambient temperature in the chamber (*see 3.1.1*);
- c) Duty cycle (*see 3.4*);
- d) Maximum permissible external surface temperature (*see 4.3*);
- e) Number of shelves and adjustable heights (*see 4.5*);
- f) Dimensions of viewing window (*see 4.6*);
- g) Relevant details and requirements of terminal panels (*see 4.7*);
- h) Dimensions of porthole (*see 4.8*);
- j) Bellows or gloves required to cover porthole (*see 4.8.1*);
- k) External and internal finish (*see 4.11*);
- m) Provision for castor wheels (*see 4.12.3*);
- n) Interlock provision, if required [*see 5.1 (a)*];
- p) Automatic test programming, if required (*see 5.1.1*);
- q) Total power supply input (*see 6.1*);
- r) Safety alarm if required [*see 7.2 (e)*]; and
- s) Any other characteristics or parameters with tolerances.